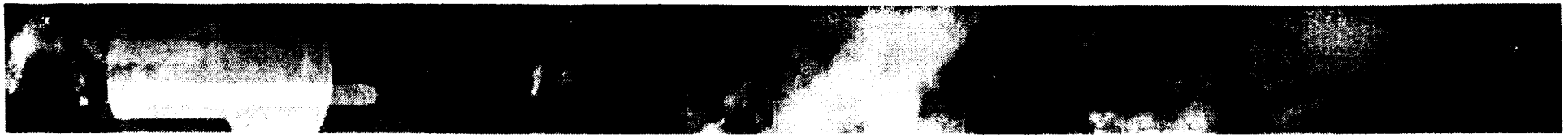

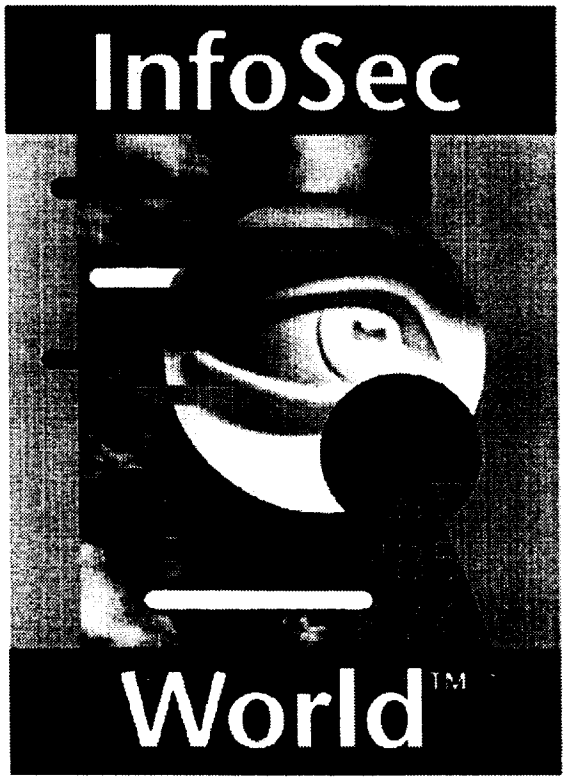

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Managing a Vulnerability Testing Program

Session 8

John Ray

Monday, February 26, 2000
10:30AM

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Key Points

- Vulnerability Testing is Essential
- The Approach must be Clear
- Keep the Community Informed
- Set a Target and Report Progress

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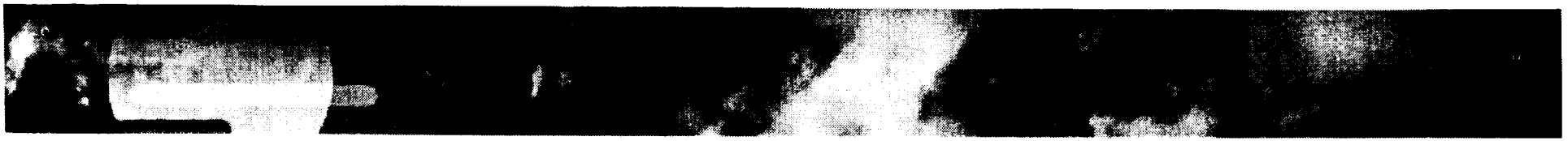

What This Talk is Based On

Security vulnerability testing program, implemented at NASA Ames Research Center from October 1998 to present, which resulted in measurably improved security and a decrease in the number of system compromises experienced.

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Some Background

- Increasing number of system compromises
  - Hackers exploiting known vulnerabilities
  - Excessive down time and costly recovery
  - Bad publicity
- Security program was in place
  - Policies and procedures were in place
  - Roles and Responsibilities were assigned
  - Security bulletins and associated patches were distributed
  - Security training classes were offered
- This alone was no longer sufficient

The Operational Environment

- Campus of over 10,000 networked computers
- Open network
  - Every computer had direct internet access
- Inconsistencies in system administration
  - Uneven application of system security patches
  - Some organizations had no systems administrators
    - Systems "hidden" in research labs
    - Researchers were "systems administrators"

Ideas for a Vulnerability Testing Program

- Use a commercial network security scanner
- Get systems administrators involved
- Identify organizations which need help
- Demonstrate vulnerability
- Provide management with regular reporting
- Demonstrate improvement

Initial Rules and Assumptions

- Select a target set of vulnerabilities - "Top 20"
- Scan the entire campus, organization by organization
- Inform everyone ahead of time when scans will occur
- Do not publish individual vulnerability results
- Make vulnerability scanner software available to all who wanted it
- Perform scans on a regularly scheduled basis

Managing Vulnerability Testing Rolling It Out

- Defining objectives for management
- Preparing for vulnerability testing
- Conducting the test
- Reporting test results
- Achieving compliance
- Lessons learned and pitfalls

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Defining Objectives for Management

- Explain the problem
- Describe the approach
- Describe the methodology
- Define the Return on Investment (ROI)

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Explain the Problem

- Describe hacking and exploiting are "known vulnerabilities"
- Use recent events - in your organization or in the News
- Do not forget to include "War Stories" - your or others
- Talk about lost of productivity -
- Talk about liabilities - who has "deep pockets"
- Talk about your company making headline news
- Mention lost of customer confidence -

Describe the Approach

- Define the scope - not a "Big Brother" activity
- Establish the program as a cooperative initiative with System and Network Administrators
- Talk about the training and improving skills aspects
- Explain "Empowerment" and "Buy-in" from sharing the tool
- Talk about the tool and it's capability to provide references needed corrective actions

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Describe the Methodology

- Identify a set target vulnerabilities placing networked systems at risk;
- Establish a metric to track success in reducing the risks from the target vulnerabilities;
- Set a target goal for the metric to meet;
- Conduct scans of all systems for the target vulnerabilities;
- Notify the responsible line mangers and System Administrators of the findings;

Describe the Methodology Cont.

- Set a window for corrective actions to be completed;
- Repeat scans to ensure corrective actions were taken;
- Report vulnerabilities until they are either
  - Signed off as an acceptable risk by a line manager or
  - Corrective actions are taken;
- Evaluate the success of the program in a year;
- Review target vulnerabilities and make adjustments; and
- Set metrics for next goal.

Return on Investment (ROI)

- Estimates cost of resources required
  - Software, hardware, training - one time cost
  - Maintenance for S/W and H/W - on going cost
  - Personnel to conduct testing and analysis results - on going cost
  - Site other organizations' programs for staffing levels and resources

Return on Investment (ROI) Cont.

- Review impacts to the company from a compromised system
  - Lost productivity
  - Lost in customer confidence
  - Liability issues
  - Recover cost - continuity of business
    - Use numbers that will not draw debate (e.g., $50/hr/person)
  - Time spent dealing with news reporters
  - Site real cases and the impact on the victim company

Return on Investment (ROI) Cont.

- Risk of a major compromise vs. cost of a Vulnerability Testing Program
  - Do you have a case?
  - Occurrences per year times cost per occurrence times number of years = risk

    2 x $80,000 x 3 = $480,000
  - One time costs + (maintenance cost + labor cost) times number of years = cost

    60,000 + (8,000 + 80,000) x 3 = $324,000

Points to Remember When Defining Objectives

- Clear and understandable problem
- Open approach with team building, training, and "empowering"
- Well designed result oriented methodology with specific objectives/metrics
- Documented ROI initiative

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Preparing for Vulnerability Testing

- Test Preparation
- Informing the Community
- Scheduling Events

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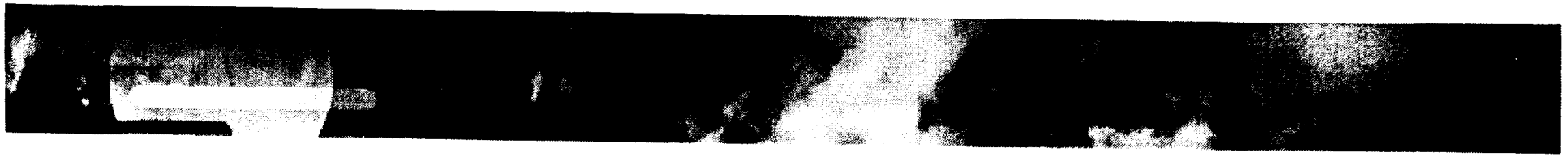


Test Preparation

- Identify the systems to be scanned
  - Scan everything - systems, servers, routers, switches, printers, etc.
  - Try to eliminate multiple address for the same system
  - Group the addresses by management organizations
- Identify a target list of vulnerabilities to test
  - Chose exploits which do not give false positives
  - Chose exploits that can be fixed with minimum cost
  - Pick a limited target set to reduce testing time

Test Preparation Cont.

- Train the Staff
  - Ensure those doing the testing get the proper training
  - Train the Help Desk to identify and handle problems arising from scans
- Practice, Practice, Practice
  - Start with a few practice scans
  - How many addresses can you scan at once?
    - Monitor the traffic load on the routers
  - Is the scanner detecting exploits like they should?
  - What do the results look like?

Informing the Community

- Educating the community
  - Raise awareness to the problem
  - Explain the "Vulnerability Testing Program"
  - Ensure the community understands the goals
- Involve the System and Network Administrators
  - Describe the tools being used
  - Offer the tools for self testing
  - Provide training for the tools
  - Establish a Bird-of-Feather (BOF) to share experiences

Informing the Community Cont.

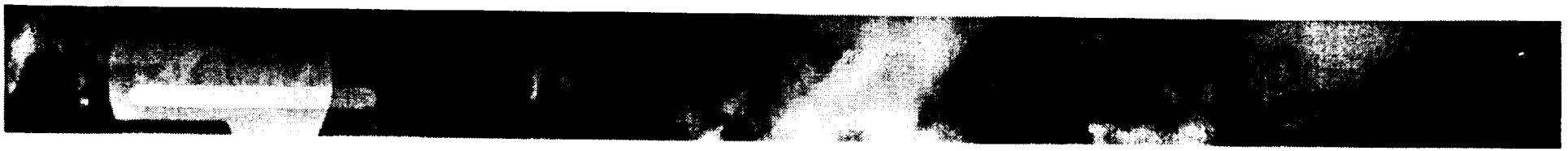
- Met with the line manages that will be receiving the testing results
  - Show them sample reports
  - Demonstrate a vulnerability scan, the results, and the references for taking corrective action
  - Explain the reporting that will be made to senior management

Scheduling Events

- Identify critical systems needing TLC
  - Work closely with the Systems Administrators
  - Schedule off peak testing periods
  - Monitor the testing
- Identify other scheduled activities
  - Central network backups
  - Software management pushes or data pulls
  - Network maintenance and upgrades

Points to Keep in Mind When Preparing for Vulnerability Testing

- Identify what is to be tested
- Learn to use the tools
- Raise the communities awareness
- Get the System and Network Administrators involved
- Alert the line managers
- Coordinate testing with other network activities



Conducting the Test

- Preparations
- Test Monitoring
- Validating and Analyzing the Results

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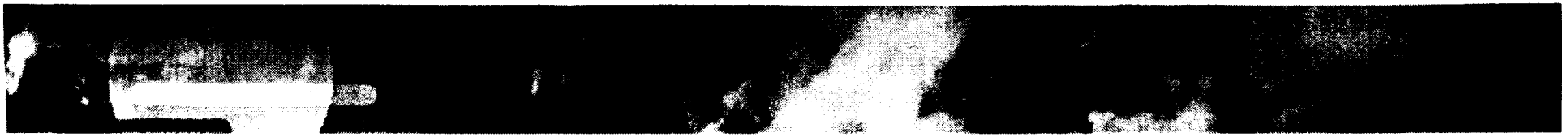
Test Preparations

- Make notifications prior to testing
  - Alert those System and Network Administrators being scanned
  - Provide the Help Desk with systems being scanned
- Conduct a test from the outside
  - Test systems from outside the perimeter / Firewall
  - Provides management with the outsider risk

Test Preparations Cont.

- Conduct tests from behind
  - Test systems behind Firewalls
  - Test systems behind routers and switches that enforce rules
  - Provides management with the insider risk



Test Preparations

Test Preparations Cont.

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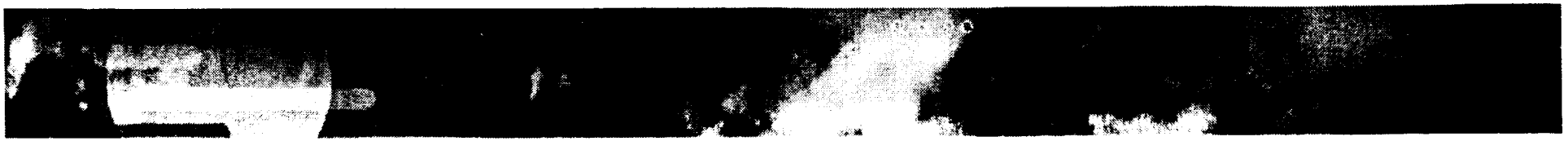
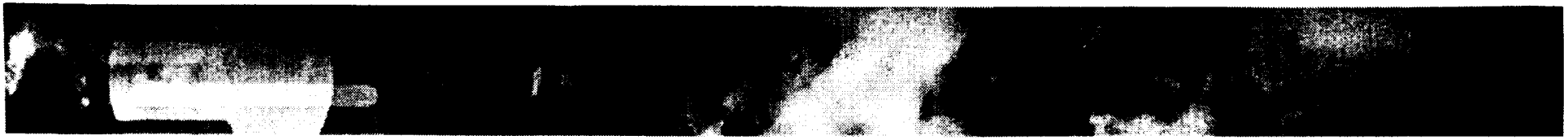


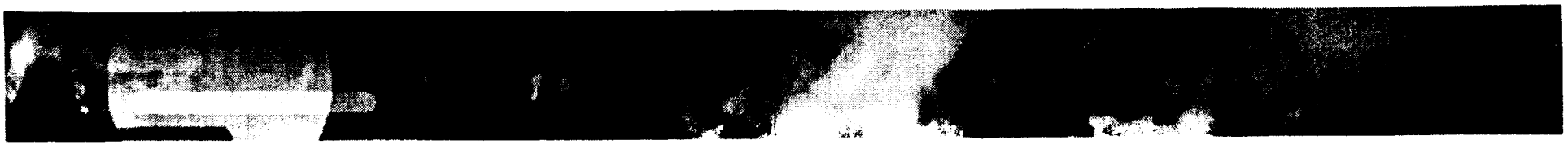
Reporting Test Results

- Establish a Baseline
- Choosing a Report Format
- Presenting the Results to Management



Monitoring the Test

- Are you getting results back?
  - Make sure the software does not hang
  - Check the systems addresses being reported
- Is you test being blocked?
  - Coordinate testing times so that scanning is not blocked
- Did the testing run to completion?
- What percent were actually tested?

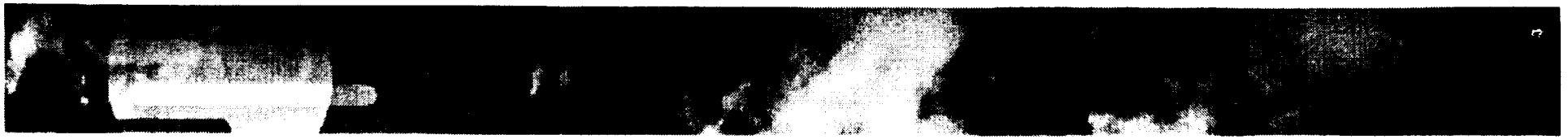


Validate and Analyzing the Results

- Spot check the results
  - Pick some "friendly" System Administrators
  - Ask them to validate the reported vulnerabilities
- Provide results to the responsible System Administrators
- Determine what percent of the system were actually tested

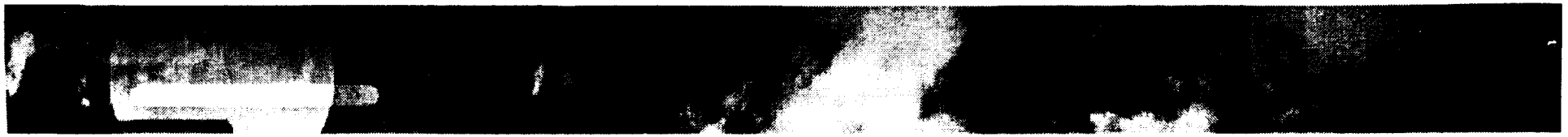
Establish a Baseline

- By the company's security posture (total vulnerabilities)
  - Goal of reducing the total vulnerabilities by a percentage
  - Embarrasses few with little pressure to take corrective action
- By an department/branch security posture (total vulnerabilities)
  - Goal of reducing the total vulnerabilities by a percentage
  - No one wants to be the highest (Red)
  - Embarrasses lots of folks and builds resentments
  - Unfair to those already managing their security risk



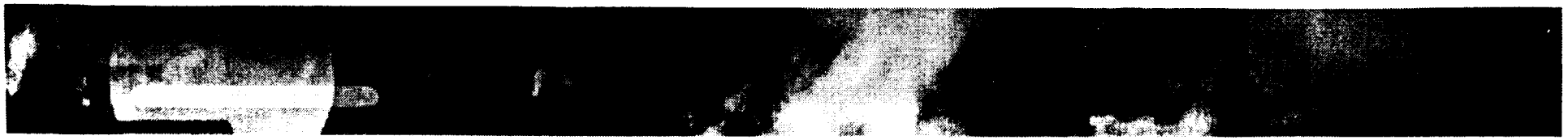
Establish a Baseline Cont.

- By major organization's security posture (total vulnerabilities)
  - Use vulnerabilities as a ratio in each organization
    - Ratio = vulnerabilities detected to systems scanned
  - Goal of reducing the ratio to a target level
  - Enough embarrassment to get corrective actions
  - Number of systems can change will little impact upon the ratio
  - Those practicing good secure are not punished



Choosing a Report Format

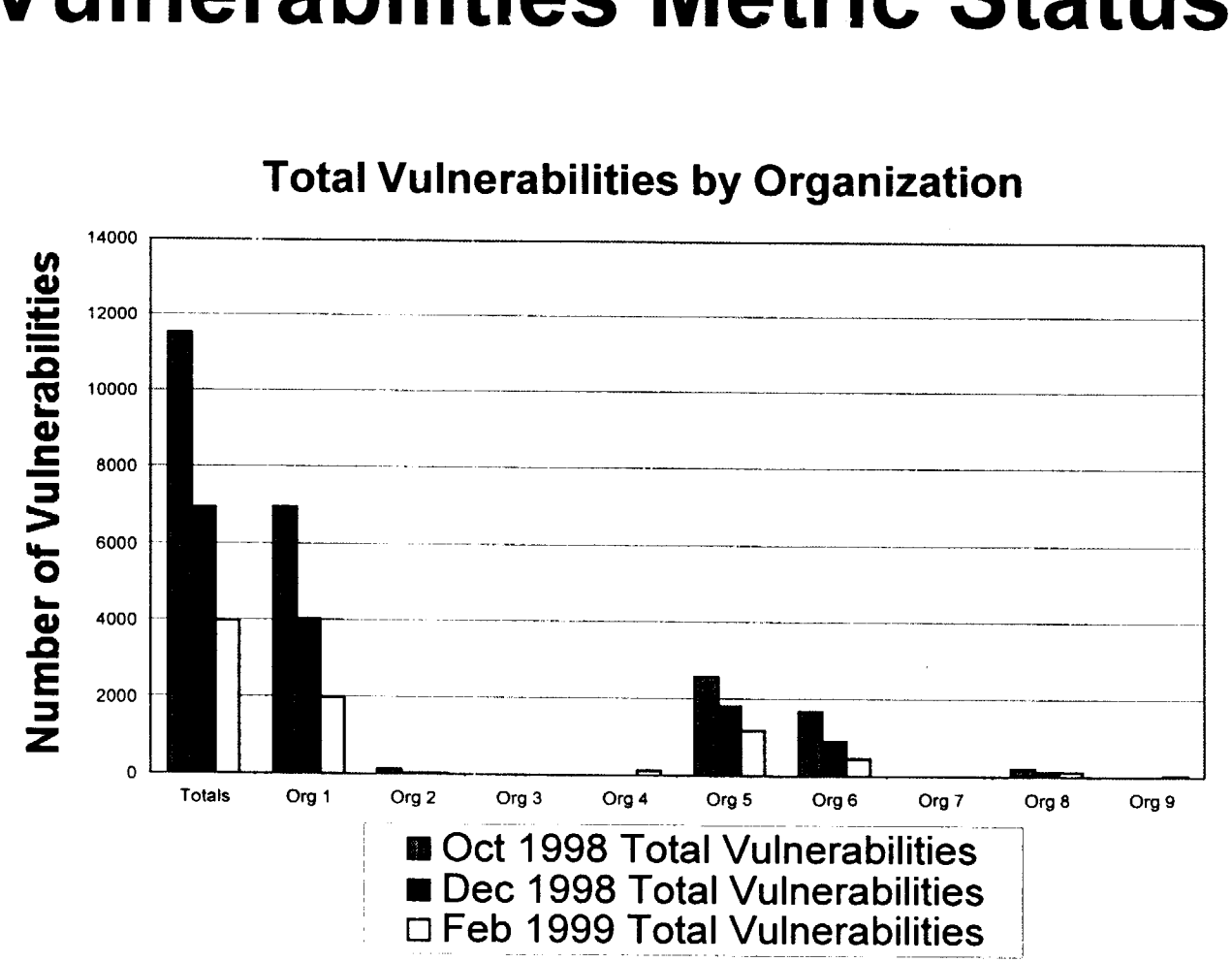
- Numbers, Bars, Pies, or Lines?
- How technical is your target audience?
- How will results from a second or third report look on the chart?



Choosing a Report Format Cont.

- How much time do you have?
  - Have a chart tracking overall company results (improvement over time)
  - Have a chart tracking major organizations' results
    - Show improvements/declines from previous tests
    - Compare all organizations with the target goal

Vulnerabilities Metric Status



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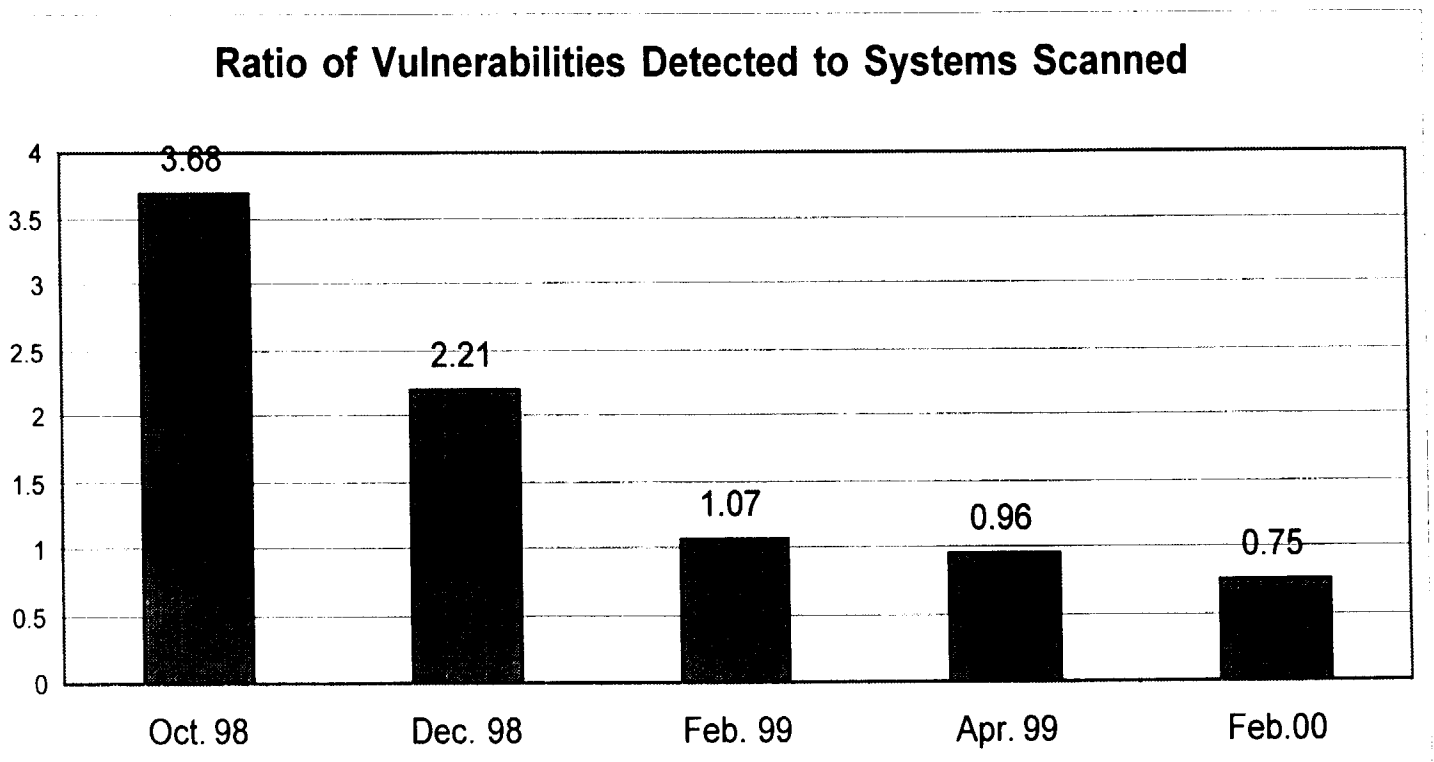
Vulnerabilities Metric Status



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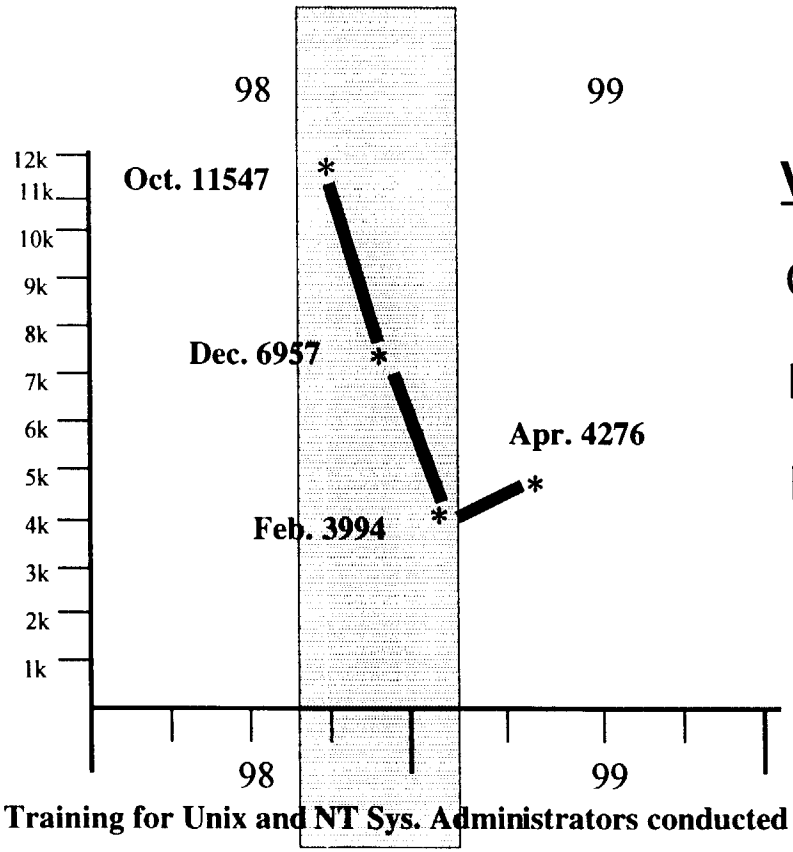
Scanning Program Results

Vulnerabilities Detected by Scans



Ratio
Vulnerabilities / System

Oct. 11547/ 7824 or 1.47

Dec. 6957/ 7903 or .88

Feb. 3668/ 8566 or .43

Apr. 4276/ 8874 or .48

IT Security Training for Unix and NT Sys. Administrators conducted during this period.

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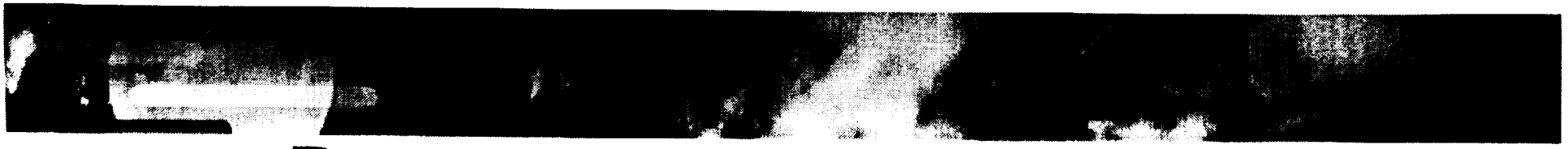
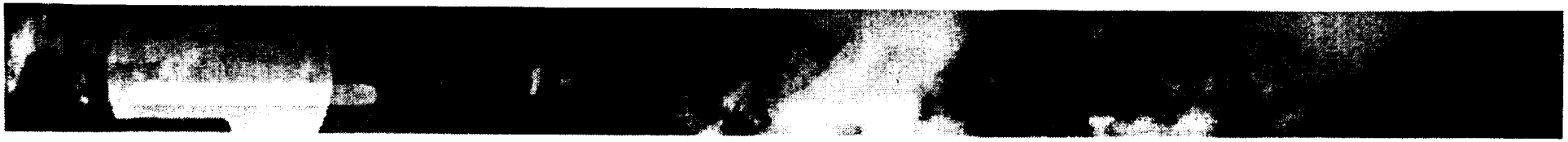


Presenting the Results to Management

- Quick update of the threat/problem
  - News items or "war story"
- Brief reminder of the program goals
- Chart showing latest test results
- Chart comparing current with past results
- Chart showing next scheduled test
- Sit down quickly



Achieving Compliance

- Work from the Bottom
- Work the Middle Managers
- Play Hardball at the Top

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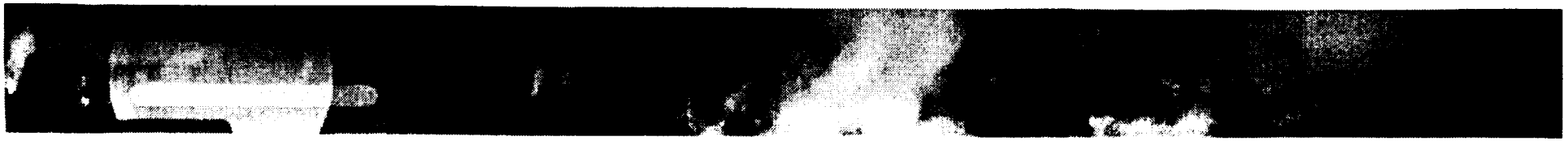

Work from the Bottom

- Encourage System Administrators to test themselves
- Provide the results for review and comment
- Host "Birds-of-a-Feather" meetings for sharing experiences
- Host lunch time seminars on the vulnerabilities and security tools
- Bring in speakers from other companies

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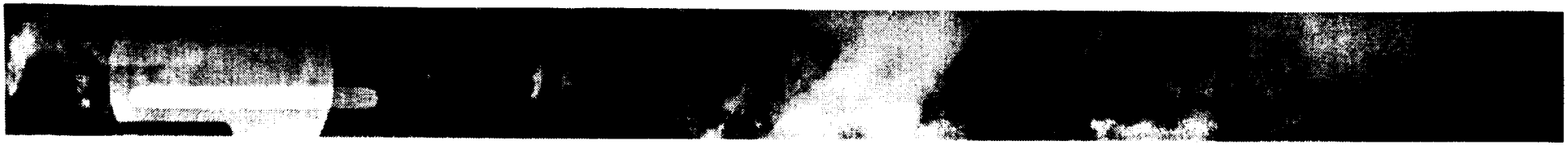

Work the Middle Managers

- Show understanding for their limited resources
  - Offer to give presentations at Staff meeting
  - Keep meeting and briefing short and focused
- Create "Shining Stars"
  - Assist a couple of departments/branches to improve
  - Others will have to show improvements

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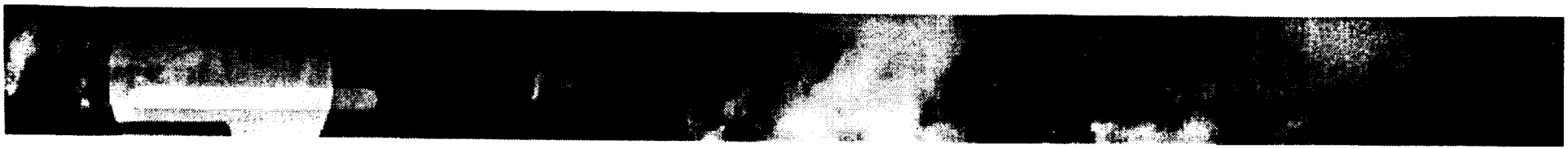

Play Hardball at the Top

- Time with Senior Management is precious
- Regular status briefings are essential
- Milestones must be clear (Stop Light Chart)
  - Zero to 30% improvement: RED
  - 30% to 90% improvement: YELLOW (easy to get yellow)
  - 90% to 100% improvement: GREEN (hard to get green)
- Ensure each organization is on the "Stop Light Chart"
- No one wants to be in last place!

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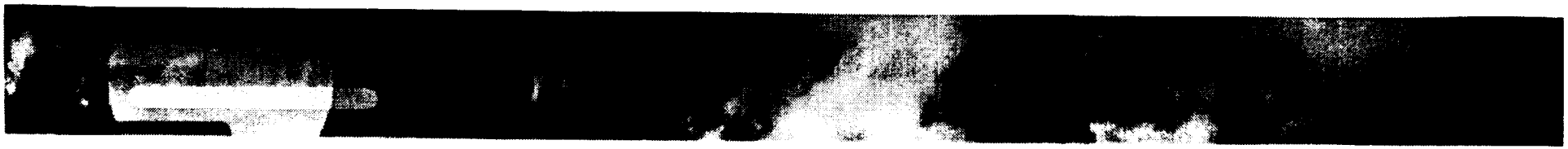

Example "Stop Light Chart"

Company Organizations	Password Problems	Buffer Overflows	Software Outdated	Unused Ports Open	Remote Sharing	Unrestricted Access
Code A		Yellow	Yellow	Yellow		
Code B						
Code C	Green	Green	Yellow			
Code D	Green	Yellow	Yellow			
Code E	Green	Green	Green	Green	Yellow	
Code F	Green	Green	Yellow	Yellow	Yellow	
Code X	Green	Green		Green	Green	Yellow
Code Y	Green	Green	Yellow	Yellow		
Company Total	Yellow	Yellow	Yellow			

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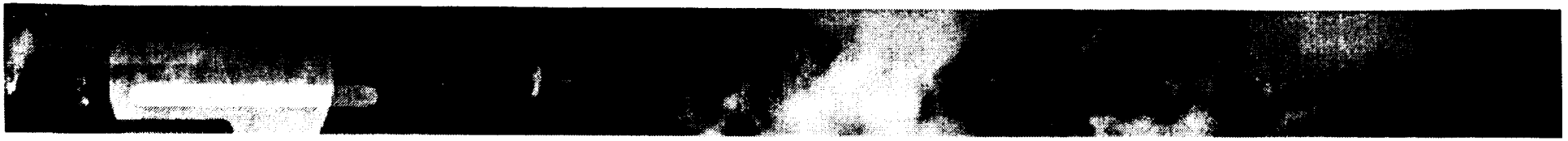

Lessons Learned and Pitfalls

- Vulnerability Testing Tools
- Conducting the Test
- Informing the Community
- Presenting to Management

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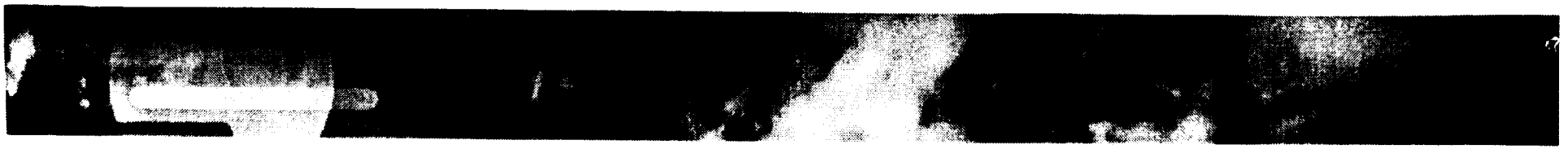


Vulnerability Testing Tools

- Start scanning with a small number and work up to determine your router's load and work closely with your Network Administrator
- Speed up the testing process by targeting a limited number of vulnerabilities
- Ping for valid host - don't test every address you own
- Break up the testing by department/branch - scanning runs better

Conducting the Test

- Give System Administrators advanced warning
  - Prevent logging server denial of service
  - Prepare systems for brute force password testing and failure lock outs
  - Modify router tables to allow (not block) your testing system
- Testing about every 2 months allows time for corrective actions to be taken

Inform the Community

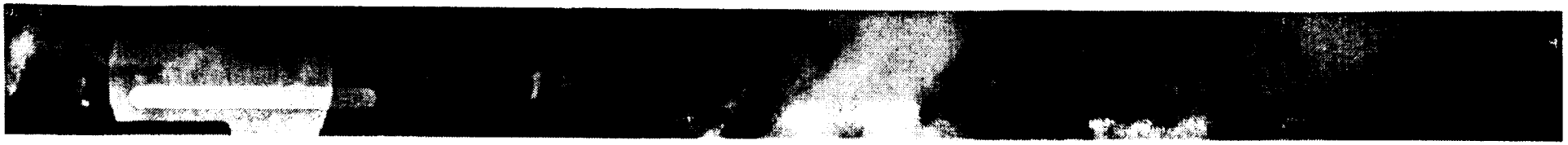
- Avoid working in a vacuum
  - User are afraid that their activities are being monitored
  - System Administrators may feel their skills are being audited

Inform the Community Cont.

- Provide the testing tool; but **BEWARE** not to allow "wayward" testing
  - Ensure you can generate custom keys for System Administrators to use
  - Ask for the addresses they will be testing
  - Be sure they also inform their customers

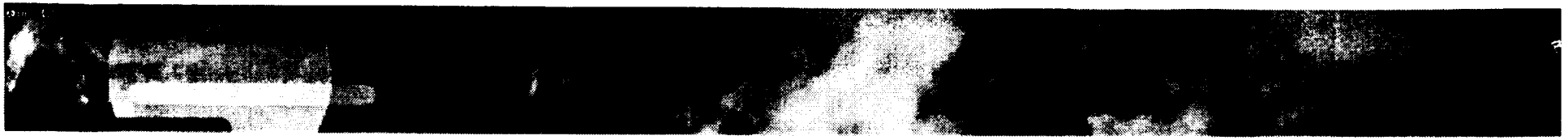
Presenting to Management

- First report to management should be an overview
- First "Stop Light Chart" should have no colors - warning of things to come
- Avoid surprising managers
  - Notify each manager of their result ahead time
  - Provide support for those trying to improve but facing obstacles



A Note About Scan Results

- After the third or forth scan, improvements will begin to level off
  - Fixes cost resources
  - Fixes impact performance
- Solution - Phase II
  - Introduce complex vulnerabilities



Summary

- A good vulnerability testing program can help reduce system compromises
- Provides a way of assessing and measuring improvements in security
- Motivates everyone to get involved